

REMARKS

By this amendment, claims 13 and 19 have been amended, claim 15 has been canceled, and new claim 26 has been added. Support for the changes to independent claim 13 can be found, *inter alia*, in canceled claim 15 and at page 9, line 31 through page 10, line 4 of the specification. Claim 19 has been amended to change its dependency from canceled claim 15 to claim 13. Support for new claim 26 can be found in Figures 1A, 9, 15 and 16. Claims 1-12, 18, 20 and 24 stand withdrawn from consideration. Claim 14 was canceled previously. Claims 13, 16, 17, 19, 21-23, 25 and 26 are presented for further examination.

The rejection of claims 13, 16, 23 and 25 under 35 U.S.C. § 103(a) over Taguchi, US 6,469,448, in view of Baldwin, US 6,280,563, and Okabe, JP 2000-355771 is respectfully traversed with respect to the amended claims.

The invention relates to a plasma processing apparatus for treating an object with plasma. The apparatus is configured to supply radio-frequency power into a process chamber to generate the plasma.

As recited in independent claim 13, the apparatus comprises a plurality of metal-based inductively coupled radio-frequency antennas that penetrate a chamber wall and are disposed in the process chamber. The antennas are arranged to provide linear lines so that the directions of respective electric currents in adjacent antennas are the same. Claim 13 also requires that adjacent antennas are parallel with each other on the same plane which is parallel to the object to be processed and, as amended, that the radio-frequency

antennas disposed in the process chamber are covered with an insulating material so that the radio-frequency antennas do not directly contact the plasma.

By requiring that adjacent antennas are in parallel with each other, on the same plane, and parallel to the object to be processed, the direction of the electric current flowing in adjacent antennas is the same (see Figure 1A). As shown in Figure 1B, with such an arrangement of the current through the antennas, the induction electric fields in the respective plural antennas are strengthened by mutual interaction (see, e.g., page 9, line 31-page 10, line 4). Thus, with the above structure, the apparatus according to the present invention can efficiently generate a high-density plasma, and particularly a high-density plasma for plasma treatment of large area substrates (see, e.g., page 18, lines 4-8 of the specification).

None of the references teach or suggest a plasma processing apparatus having a plurality of inductively coupled radio-frequency antennas that are arranged within the apparatus in the manner required by claim 13, much less such an arrangement of antennas where the antennas are covered with an insulating material so that they do not directly contact the plasma.

Taguchi discloses an inductively coupled plasma (ICP) source wherein a plurality of one-turn antenna coils are disposed along the circumferential side wall of the plasma generating chamber. The one-turn coils of Taguchi are not linear, however, much less located inside the processing chamber. Further, Taguchi does not disclose or suggest inductively-coupled antennas that are covered with an insulating material. These deficiencies of Taguchi are not

remedied by any of the secondary references, whether considered independently or in combination.

The secondary reference of Baldwin teaches an ICP source having a coiled antenna. The antenna of Baldwin, however, is disposed on a top plate of a chamber and, as shown in Figure 2, comprises non-linear coils that are branched from the center to the periphery of the top plate.

Okabe discloses a film deposition system having electrodes 4,5 arranged in parallel in the same plane. Applicants note, however, that in the system of Okabe, plasma is formed in a discharge space 2 between the electrodes by applying a high voltage between the electrodes. Notably, in such a system, it is important to apply a high voltage between two electrodes to form a glow discharge, and it is not important whether the current flow through adjacent electrodes is in the same direction or in opposite directions. Thus, Applicants submit that even if Okabe were combined with Taguchi and Baldwin, one skilled in the art would not configure the antennas of Okabe so that the directions of the electric currents in adjacent antennas were the same. In view of the foregoing, reconsideration and withdrawal of the rejection are respectfully requested.

The rejection of claims 15 and 19 under 35 U.S.C. § 103(a) over Taguchi in view of Baldwin and Okabe, and further in view of Glukhoy, US 2003/0168172, the rejection of claim 17 under 35 U.S.C. § 103(a) over Taguchi in view of Baldwin and Okabe, and further in view of Holland, US 5,975,013 or Takagi, US 2004/0020432, and the rejection of claims 21 and 22 under 35 U.S.C. § 103(a) over Taguchi in view of Baldwin and Okabe, and further in view of Grimbergen,

US 6,390,019 are respectfully traversed. Applicants note that claim 15 has been canceled.

The secondary references of Glukhoy, Holland, Takagi and Grimbergen fail to remedy the deficiencies of Taguchi, Baldwin and Okabe for at least the same reasons that these secondary references fail to remedy the deficiencies of Taguchi, Baldwin and Tonotani with respect to independent claim 13, as set forth in the Reply filed on June 4, 2007. Accordingly, claims 17, 19, 21 and 22, which depend either directly or indirectly from claim 13, are patentable at least for the reasons that claim 13 is patentable. Reconsideration and withdrawal of these rejections are respectfully requested.

Applicants respectfully submit that new claim 26 is also patentable over the cited prior art for at least the reasons that apply to independent claim 13, as well as the additional elements recited therein. In particular, Applicants submit that the additional feature of a process chamber having a second chamber wall opposed to a first chamber wall such that each antenna penetrates both the first chamber wall and the second chamber wall is not disclosed or suggested by the cited references.

In view of the foregoing, the application is respectfully submitted to be in condition for allowance, and prompt favorable action thereon is earnestly solicited.

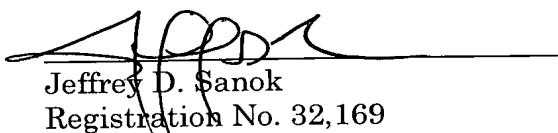
If there are any questions regarding this response or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

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Reply to Office Action
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If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket # 101249.52602US).

Respectfully submitted,

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